

upper Michigan. Killing frosts or freezing temperatures occurred also during the month at Castile, Gabriels, Lake Placid Club, Angelica, Nehasane, and Tupper Lake, all in the highlands of New York. In this section of the district and in that of Vermont the lowest temperatures were recorded for the most part on the 1st, just before the period of hot weather set in. The lowest reading made in any portion of the Lake region during July was 22°, at Seney, in the upper peninsula of Michigan, on the 16th.

PRECIPITATION.

Precipitation was below the normal over the Lake Superior region and from the Pennsylvania section eastward. The departures reached about -1.20 inches in New York and Vermont and nearly -2 inches in the extreme northwest. Throughout the remainder of the district, in general, the amounts received were greater than the seasonal average and were exceptionally heavy in portions of Wisconsin, lower Michigan, and Ohio. In eastern Wisconsin out of 30 stations 18 reported monthly amounts of 6 inches or more; in northern Ohio out of 30 stations 13 received 6 inches or more; while several stations in Wisconsin and lower Michigan recorded more than 10 inches. In northern Indiana, although the table shows a deficiency of -0.20 inch, it is probable that were normals available for the entire number of stations in that section the average would show an excess rather than a deficiency.

As previously stated, but little rain fell in the eastern portions of the district until after the close of the first decade, and droughty conditions continued from the previous month. The streams in some localities became very low, and fear was entertained that industries depending upon water power would be forced to suspend operations even in the latter portion of the month, when showers were frequent, as most of the water which fell was retained in the overdry soil. Except in the extreme northwestern sections, the remainder of the district was visited by frequent rains during the whole month and many of the individual falls were excessive. On the 23d-24th 7.31 inches fell in 24 hours at Cecil, Wis., and 6.31 inches at Manitowoc, in the same State. At the latter place the observer reports the amount as the greatest 24-hour fall in 50 years of record.

The 6th-7th, 13th-16th, 20th-21st, 23d-24th, and 28th-30th marked the periods of heaviest rainfall, and thunderstorms were numerous on these dates. In lower Michigan the severity of these storms was especially pronounced on the 13th and 28th. A special report is printed below, descriptive of a small tornado which passed through Grand Rapids on the former date. On the 28th at Harrison, in Clare County, a severe thunderstorm with high winds was accompanied by heavy hail which completely covered the ground and in places was banked to a depth of 12 to 18 inches.

MISCELLANEOUS.

During dense fog on the southern end of Lake Huron on the early morning of the 14th the steamer *Northern Queen* rammed the steamer *J. G. Grammar*, which was lying at anchor north of the Corsica Shoal Lightship. The injured vessel sank within a few minutes, but was subsequently raised. None of the crew was lost. Dense fog also occurred in several other localities during the course of the month, but no further reports of damage from this cause have been received.

JULY, 1912, LAKE LEVELS.

The following data are from the report of the United States Lake Survey office:

Lakes.	Above tidewater, New York.
	<i>Feet.</i>
Superior.....	602.26
Michigan-Huron.....	580.48
Erie.....	572.56
Ontario.....	247.01

Lake Superior is 0.04 foot higher than last month, 0.64 foot higher than a year ago, 0.34 foot below the average stage of July for the last 10 years, 1.56 feet below the high stage of July, 1876, and 0.78 foot above the low stage of July, 1879. It will probably rise 0.1 foot during August.

Lakes Michigan-Huron are at the same stage as last month, 0.59 foot higher than a year ago, 0.62 foot below the average stage of July for the last 10 years, 3.10 feet below the high stage of July, 1876, and 0.60 foot above the low stage of July, 1896. They will probably fall 0.1 foot during August.

Lake Erie is 0.08 foot lower than last month, 0.81 foot higher than a year ago, 0.30 foot lower than the average stage of July for the last 10 years, 1.85 feet below the high stage of July, 1876, and 1.10 feet above the low stage of July, 1895. It will probably fall 0.2 foot during August.

Lake Ontario is 0.33 foot lower than last month, 1.47 feet higher than a year ago, 0.16 foot higher than the average stage of July for the last 10 years, 1.71 feet below the high stage of July, 1863, and 2.42 feet above the low stage of July 1895. It will probably fall 0.3 foot during August.

TORNADO AT GRAND RAPIDS, MICH.

[By C. F. SCHNEIDER, Section Director.]

During the early morning of Saturday, July 13, 1912, a thunderstorm of considerable severity occurred, beginning about 3.30 a. m. and ending at 10 a. m.

Shortly after 4 a. m. a small tornado passed through the center of the city, apparently touching the ground in only one place, but being near enough to the earth to cause serious damage to trees and small buildings over a path about a mile in length and varying from 200 to 1,000 feet in width. However, the path of great destruction was not over 50 to 75 feet wide.

The preceding day had been warm and sultry and the temperature did not fall as rapidly as usual during the night, the thermometer registering 76° at 4 a. m. There was a fall of 9° within 15 minutes immediately after the passage of the tornado.

The destructive effect of the tornado was first manifested at the southern boundary of John Ball Park, in the extreme southwestern part of the city. At this point several trees were uprooted and one was carried about 10 feet and hurled across the cables of the Grand Rapids & Muskegon Power Co., bringing poles and wires down in the street. The greenhouses in the park were damaged by falling branches and poles, and about one block east a small barn was overturned.

From this point to the river the storm passed through a rather thinly built-up section and did some damage at intervals. One house in process of construction was blown from its foundation and a barn was overturned.

The tornado then crossed the river and apparently dropped on the baseball grounds with full force. It unroofed the grandstand and carried sections of the roof northward from 50 to 100 feet, dropping them in the midst of an assembled crowd of farmers, grocers, and hucksters at the market. The whirling, funnel-shaped cloud was plainly seen, but owing to the darkness it had approached so near before observed that no effort could be made to get out of its path.

Through the crowd it swept in a northerly direction, its path being 50 to 75 feet wide. Wagons and automobiles were overturned and piled up, horses stampeded, and a scene of indescribable confusion ensued. Two horses were killed by the falling sections of roof from the grandstand. Nine people were injured severely, mainly by runaway teams. Many were bruised and cut by flying splinters and the general overturning of everything in the storm's path. Sheds on the north side of the market were unroofed and sections of the roofing carried 100 feet or more.

The tornado appears to have raised at this point and not again to have touched the earth, but beginning on Sheldon Avenue, just east of Monroe Avenue, about six blocks northeast of the market, it was near enough to the ground to prostrate trees in a path about two blocks wide, extending eastward four blocks. No evidence of a twisting action could be discerned at this point, as the trees all fell toward the northeast.

The local office of the Weather Bureau is about three-fourths of a mile northeast of the market and about four blocks north and slightly west of the point on Sheldon Avenue where the destruction of shade trees began. At 4.13 a. m. the wind shifted from south to west and immediately increased to a maximum velocity of 31 miles per hour, the extreme velocity for one minute being 33 miles per hour at 4.15 a. m. Very heavy rain fell from 4.09 to 4.24 a. m., the rainfall for 15 minutes being 0.87 of an inch. The barograph trace showed no unusual features other than those common to severe thunderstorms. There was a decrease of 0.14 of an inch in pressure between midnight and the beginning of the storm and a sudden rise of 0.09 as the storm arrived.

There was another area of considerable damage to trees several blocks south of the path of the tornado, possibly due to another whirl which failed to touch the earth at any point.